

THURSDAY, JUNE 28, 1900.

CHRISTMAS ISLAND.

A Monograph of Christmas Island (Indian Ocean), Physical Features and Geology. By C. W. Andrews, with descriptions of the Fauna and Flora by numerous contributors. Pp. xv + 237. (London: Published by order of the Trustees of the British Museum, 1900.)

TILL 1887 Christmas Island, which is situated in the Indian Ocean nearly a degree to the south-south-west of Batavia, was scarcely known, even by name, to the average Englishman, and only the low-lying shore had been visited by explorers; the steep cliffs, together with the forest with which the island is clothed, forming a barrier which had hitherto prevented access to the central plateau. In that year the Commander of H.M.S. *Egeria*, with the assistance of a landing party, succeeded in cutting his way into the interior; and two years later the island was leased by the British Government to a trading company. Since it contains an area of about forty-three square miles, and appears never to have been inhabited by aboriginal tribes, it presented a most favourable opportunity for studying the fauna and flora of an oceanic island of considerable size situated at no very great distance from a considerable land-mass—the Sunda Archipelago. Down to the time mentioned, it appears, indeed, to have been the largest uninhabited tropical island extant; and as the discovery of valuable deposits of phosphates in the interior indicated that its pristine conditions would soon be rudely disturbed, it was evident that if a biological survey was to be undertaken at all, there was no time to be lost. Fortunately, Sir John Murray interested himself strongly in the matter, and it was eventually arranged that Mr. C. W. Andrews, of the British Museum, who is both a geologist and a zoologist, should undertake the work. He accordingly spent ten months on the island during the years 1897-98; and the present volume, in which he has had the assistance of a number of specialists, is the result of his labours.

As is evident by their permitting a member of their staff to undertake the task, the Trustees of the British Museum gave their support to the exploration; and it is a matter for congratulation that they have seen fit to publish the results in the same form as the Museum "Catalogues." A wise liberality has been exercised in the matter of illustration, the plates (some coloured) being numerous, while a considerable number of reproductions from photographs are given in the text. These latter have, however, received but scant justice at the hands of the printer; and it is, indeed, with some surprise that we notice the volume bears the name of a local firm of printers.

Situated at a distance of over 190 miles from the nearest land, with the intervening ocean attaining a depth of more than three miles, Christmas Island appears to have derived its limited fauna from the Sunda Archipelago, of which indeed it probably once formed a part. The length of its isolation is, however, indicated by the circumstance that four out of its five indigenous mammals are peculiar species, the fifth—a Shrew—being a local

variety of an Assam and Tenasserim form. The majority of the few land birds are likewise distinct, the most striking being a Goshawk (*Astur natalis*), an Owl (*Ninox natalis*), and a White-eye (*Zosterops natalis*), specimens of all of which were first collected by Mr. J. J. Lister during a flying visit to the island in 1890. As regards the fauna generally, it exhibits no greater evidence of affinity with that of the Mentawai chain of islands, running parallel with Sumatra and Java, than with that of the two islands last named. And the hypothesis that Christmas Island formed the termination of a "Mentawai Peninsula" must accordingly be given up.

One of the main objects of the exploration of the island was to ascertain whether its geological structure would throw any further light on the vexed question of the origin of atolls. As the result of his observations, Mr. Andrews is led to believe that, from the absence of a sufficient thickness of reef-limestone, Christmas Island, although originally an atoll, could not have been formed in the manner required by the Darwinian theory, as the amount of subsidence which has taken place would have been quite insufficient. That a certain amount of subsidence may have occurred in the early history of the island, Mr. Andrews considers to be quite possible.

"It may, of course, be objected," he writes, "that Christmas Island was never a typical atoll, and to this objection no answer is possible; but since it can be shown that at one time it must have consisted of reefs and islands approximating very nearly to those seen in atolls which are regarded as typical, the determination of the nature of the foundations upon which these reefs and islands rested is at least a step in the right direction. . . . In this case the basis of the island is almost certainly a volcanic peak, the foot of which is now some 2400 fathoms below the level of the sea, and that on its summits and flanks great accumulations of Tertiary limestones have been deposited, and in some cases are interstratified with the products of the eruptions, probably for the most part submarine, which took place from time to time. The oldest of the volcanic rocks are trachytic, the newer basaltic. The last of the eruptions was accompanied by the formation of thick beds of volcanic ash, and it is upon these that the great mass of the Miocene (Orbitoidal) limestones rests."

The occurrence of such a thickness of Tertiary deposits (ranging from the Eocene or Oligocene upwards) is unknown in any other oceanic island. It is important to notice that these rocks, allowing for a difference in the proximity of land at the time of their deposition, are very similar to those of South Java; but the author considers that there are difficulties in believing that the two series of sediments were deposited in a continuous area, as this would involve great local dislocations. Accordingly the volcanic peak theory is adopted in preference to such a view.

In speaking of elevation and depression, the author is careful to guard himself by stating that such terms are merely used in relation to the sea-level; and it would appear, from reading between the lines, that he is rather in favour of an actual alteration of the sea-level in these districts. It may further be inferred that he does not intend his conclusions as to the mode of origin of Christmas Island to affect the case of other atolls, his idea apparently being that all atolls are not of precisely similar origin.

The rocks which have brought Christmas Island into the most prominent notice are the thick beds of nearly pure lime phosphate capping several of the higher hills. It is inferred that this deposit has been formed by the action of beds of guano on limestone forming the summits of the low islets presumed to have existed previous to the first elevation of the present island. Another phosphatic bed is considered to have been produced by guano acting on volcanic ash. It is for the purpose of working these phosphates that the island has been leased by a commercial company.

Although the greater part of the volume is of a highly technical nature, it must not be inferred that this is the case with the whole of its contents. As an example of its lighter side, the excellent account of the habits of the Frigate-bird may be cited. These birds, which form the main support of the present colony of the island, are of an inquiring and fearless disposition.

"The usual way of obtaining them is," writes the author, "for a man to climb into the topmost branches of a high tree near the coast, armed with a pole eight or ten feet long and a red handkerchief. The latter he waves about, at the same time yelling as loudly as possible. The birds, attracted by the noise and the red colour, swoop round in large numbers, when they are knocked down with the long pole. In this way sufficient birds to supply the small colony with food can usually be obtained in an hour or two; occasionally, however, in unfavourable states of the wind, they are difficult to procure."

From first to last, the exploring, the collecting, and the descriptive and literary portions of the book have been thoroughly well carried out. And, despite the fact that no far-reaching or epoch-making discoveries in either zoology, geology, or distribution have been made, all concerned in the production of the volume before us (save the printer) are to be heartily congratulated on the manner in which they have executed their respective tasks.

R. L.

A NEW WORK ON SILVER.

Metallurgy of Lead and Silver. Part ii. Silver. By Henry F. Collins. Pp. 352. (London: Griffin and Co., Ltd., 1900.)

WE recently had occasion to notice the first volume of the present work, and to speak favourably of its merits. We are pleased to find the second portion equally good. It has been a source of great regret that the distinguished master of metallurgy, the late Dr. Percy, did not live to complete his projected work on Silver, instead of leaving what has been termed a splendid fragment: and as no book claiming to give a full account of the metallurgy of the subject has been published since, we cordially welcome the advent of a further contribution. It is perhaps unnecessary to point out how closely interwoven is the metallurgy of lead with that of silver, or to state that a full treatise on silver cannot be written without considerable reference to lead; and when one author is competent to deal with both branches of the subject, it affords the best means of imparting a sound knowledge of these metals. In the present case we have this additional advantage, that the editor is an

authority on all questions relating to the nature and properties of silver, together with that of assaying. The immense importance of silver in the economic relations of the United States is well known, and many attempts have been made to introduce similar relations into this and other countries; hence it may be considered one of the most important metals known to mankind. The present work is not an exhaustive treatise on silver, and is evidently intended chiefly for those who are connected with the extraction of the metal from its ores. Those ancient methods which are fast becoming obsolete have not escaped notice; for, while they may not possess much practical value at the present time, their chemical and educational value is not to be despised. Numerous references to original sources of information are given throughout the volume, and this will enable the reader to obtain fuller information than is given here. The method of procedure in special works, such as that of matte smelting at Sunny Corner (p. 268), is described at some length with clearness and precision. The author has followed the same plan as in his first volume, of economising space by giving details of the practice at different localities in the form of tabular statements. This should prove useful for reference and comparison. The book is divided into four main sections, dealing respectively with silver and its ores, amalgamation, lixiviation, and smelting processes. Of these the chapters relating to lixiviation and blast furnace smelting are the best, as they appear to be the branches with which the author is most familiar. The hyposulphite leaching process is described in a more lucid and methodical manner than we have seen elsewhere, and the advantages and disadvantages of calcium sulphide are admirably compared on p. 197. A chapter is specially devoted to hyposulphite leaching practice, in which is given details of plant, mode of working, advantages and disadvantages of lixiviation, cost, and examples of the Russell process in various localities. Data as to cost and results at mills using the Patera and Russell processes respectively are given in the form of tables on pp. 224 to 227. A serviceable chapter on the refining of lixiviation sulphides concludes the section. The fourth section, dealing with the extraction of silver by smelting processes, contains a considerable amount of information in a condensed form. The table of comparison of various systems of smelting is instructive and helpful. The construction of furnaces is made clear by the aid of figures, drawn to scale. The arguments in favour of the hot blast for smelting mattes are pertinent and convincing. Several well-compiled tables are included in this chapter. Pyritic smelting receives only a brief notice in Chapter xv., as this subject has been partly dealt with in the first volume. The subject of matte smelting in reverberatories for silver-copper ores is next considered, and the characteristics of the method, with the points of difference from blast furnace practice, are pointed out. This kind of information is often of great moment to the practical man, who has to decide on the most economic method to adopt in special cases. The final chapters deal with the treatment of argentiferous mattes, which generally require a preliminary concentration to eliminate some of the lead and iron. In some cases a direct method may be